CLAIMS

1. A method of converting an input data stream having a Program Stream (PS) format into an output data stream having a Transport Stream (TS) format, the method comprising:

(a) reading from said input data stream successive blocks of data, said input data stream including data of at least first and second elementary data streams formed and multiplexed in compliance with a PS decoder model;

(b) accumulating the data of the first and second elementary streams respectively in first and second queue structures;

(c) establishing a TS target decoder model including hypothetical first and second buffers for the first and second elementary streams respectively;

(d) generating a succession of transport packets to form said output data stream conveying said first and second data streams in said TS format, by reference to said target decoder model; and

(e) updating the status of said hypothetical first and second buffers within said TS target decoder in response to each transport packet generated and predetermined properties of said decoder model;

wherein each transport packet comprises data from either the first queue, the second queue or neither queue, depending on the scheduling of said elementary streams within the input data stream and on the state of said first and second buffers within said TS target decoder model, and wherein the method includes inhibiting reading of a further data block from said stream when, in the absence of a vacancy for data of said second elementary stream within the target decoder model, a clock reference of said input data stream advances beyond a clock reference of said output data stream by a predetermined waiting threshold.

2. A method as claimed in claim 1 wherein in the PS format at least said first and second elementary streams of data have been encoded, divided into elementary stream packets with packet headers, and the packets interleaved whole, while in the TS format such elementary stream packets are

further sub-divided into a plurality of smaller transport packets, and the transport packets of the first and second elementary streams interleaved with each other and with transport packets carrying data from neither stream.

3. A method as claimed in claim 2 wherein the subdivision of each elementary stream into elementary stream packets is the same in the input and output streams.

4. A method as claimed in claim 1 wherein the TS format data stream is of constant or piecewise constant data rate, said transport packets being of uniform size and period.

5. A method as claimed in claim 1 wherein the input stream is read in blocks, each block containing at least one whole elementary stream packet, and only packets from one elementary stream.

6. A method as claimed in claim 1 wherein each block contains a PS delivery time code, and wherein a TS transport time code is synchronised initially with the PS delivery time code and advanced with the generation of each transport packet.

7. A method as claimed in claim 1 wherein each of the PS and TS formats defines constraints as to: (i) an upper bound on the maximum time difference ("skew") between delivery times for respective presentation units in the first and second elementary streams having a common presentation time; and at least one of (ii) capacity for buffering data of each elementary stream between delivery and decoding; and (iii) rate of delivery of data of each elementary stream on the scale of one access unit from the transport stream to a buffer for decoding.

8. A method as claimed in claim 7 wherein said buffer constraint (ii) is stricter in the TS format than in the PS format for the second elementary stream, and wherein said waiting threshold is sufficient to accommodate a quantity of excess data corresponding to the difference between what can be accommodated within the buffer in the PS target decoder and what can be accommodated in the TS target decoder.

9. A method as claimed in claim 7 wherein said minimum rate constraint (iii) is stricter in the TS format than in the PS format for the second elementary stream, and wherein said waiting threshold is sufficient to allow extra time for transport of an access unit within the second elementary stream, the extra time corresponding to the difference between the shortest possible time for delivery of such an access unit within the PS format constraint and the longest possible time for delivery of the same access unit within the TS format constraint.

10. A method as claimed in claim 9 wherein said PS and TS formats permit different coding parameters to be implemented in said second elementary stream so as to vary one or both of the quantity of data to be delivered and the presentation period for each access unit, and wherein said waiting threshold is fixed in accordance with a maximum extra time required among the permitted coding parameters.

11. A method as claimed in claim 7 wherein said waiting threshold is less than one fifth the skew permitted in the program stream.

12. A method as claimed in claim 7 wherein said access unit comprises a compressed audio frame.

13. A method as claimed in claim 1 wherein the average data rate of the first elementary stream is substantially greater than that of the second elementary stream,

14. A method as claimed in claim 1 wherein data of the first elementary stream comprises encoded video pictures and the data of the second elementary stream comprises encoded audio frames.

15. A method as claimed in claim 1 wherein said TS format is compliant with the MPEG-2 Transport Stream specification, while said PS format is compliant with the MPEG-2 Program Stream specification, both as defined in ITU-T Recommendation H.222.0 and ISO/IEC 13818-1.

16. A method of reproducing a recorded audio-visual programme wherein a data stream in PS format is read from a data channel, converted to a TS format by a method as claimed in claim 1 and fed via a further channel to an TS-compatible decoder.

17. A method of re-multiplexing first and second elementary streams of data so as to generate a continuous stream of transport packets complying with a second predetermined target decoder model, the data of said first and second streams having been previously multiplexed in compliance with a different, first predetermined target decoder model, wherein said data is read on demand from an input channel and the reading of said data is constrained by reference to progress in re-multiplexing of the second elementary stream irrespective of a vacancy for data of the first stream in the second target decoder model, provided that said reading is judged sufficiently far in advance of the progress in re-multiplexing the second elementary stream to compensate for differences in the first and second target decoder models.

18. A method as claimed in claim 17 wherein each of the first and second target decoder models defines for each elementary stream a respective buffer of finite size for data to be decoded, and wherein at least for the second elementary stream the buffer is smaller in the TS target decoder than in the PS target decoder,

19. A method as claimed in claim 17 wherein the average data rate of the first elementary stream is substantially greater than that of the second elementary stream,

20. A method as claimed in claim 17 wherein data of the first elementary stream comprises encoded video pictures and the data of the second elementary stream comprises encoded audio frames.

21. A method as claimed in claim 17 wherein said TS format is compliant with the MPEG-2 Transport Stream specification, while said PS format is compliant with the MPEG-2 Program Stream specification, both as defined in ITU-T Recommendation H.222.0 and ISO/IEC 13818-1.

22. A method of reproducing a recorded audio-visual programme wherein a data stream in PS format is read from a data channel, converted to a TS format by a method as claimed in claim 17 and fed via a further channel to an TS-compatible decoder.

23. A method as claimed in claim 22 wherein said data channel comprises a recording of said input data stream on a record carrier.

24. An apparatus comprising means for receiving an input data stream in a first format wherein at least two elementary streams of data are multiplexed and means for converting the data to a second format to generate

an output stream, said converting means comprising means specifically adapted to implement a method as claimed in claim 1.

25. An apparatus as claimed in claim 24, the apparatus comprising one of a stand-alone decoder apparatus for digital video programmes, a presentation apparatus having a display for video programmes, and a reproducing apparatus for playing and optional also for recording digital video programmes.

26. An apparatus comprising means for receiving an input data stream in a first format wherein at least two elementary streams of data are multiplexed and means for converting the data to a second format to generate an output stream, said converting means comprising means specifically adapted to implement a method as claimed in claim 17.

27. An apparatus as claimed in claim 26, the apparatus comprising one of a stand-alone decoder apparatus for digital video programmes, a presentation apparatus having a display for video programmes, and a reproducing apparatus for playing and optional also for recording digital video programmes.